Increasing the Competitiveness of Missouri's Hardwood Producers: An Introduction To Lean Enterprise Principles for Sawmill Operators

Business and technical assistance to help you reduce costs and increase profits.

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INTRODUCTION

The timber industry contributes significantly to Missouri's economy. Missouri has more than 13 million acres of timberland, covering some 30 percent of the state. The forest products industry is one of Missouri's 10 largest manufacturing sectors, employing some 30,000 people, or six percent of the manufacturing workforce, with an annual payroll of $681 million.

But, the contribution to the state's economic well being should be much higher. Many timber producers are not operating at the highest level of efficiency and some are producing only lower grade forest products, from high grade raw materials.

Recognizing this, and committed to helping Missouri businesses succeed, Missouri Enterprise Business Assistance Center partnered with the Missouri Department of Agriculture to submit an application for a U. S. Department of Agriculture Federal State Market Improvement Grant. The grant application proposed a study of the industry and development of ways for Missouri's timber producers to their enhance competitiveness in the global marketplace.

That grant was approved in February 2004. The study of the industry was undertaken, the results were evaluated and this Technical Report is the first of three reports addressing the application of modern industrial methods to the hardwood timber industry.

We are confident that this first report will introduce the timber products industry to proven principles and practical means to help all segments of the timber industry enhance productivity and increase profits. This first general introduction report will be followed by reports focusing on logging and milling.

ACKNOWLEDGEMENTS

Missouri Enterprise Business Assistance Center wishes to acknowledge the following organizations, without whom, this project could not have been completed. We look forward to continued cooperative efforts with these organizations on behalf of our state's timber industry.

United States Department of Agriculture
Missouri Department of Agriculture
Missouri Forest Products Association
Missouri Department of Conservation
Missouri Department of Natural Resources

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EXECUTIVE SUMMARY

Missouri Enterprise Business Assistance Center recently conducted a survey of Missouri hardwood producers to determine if "Lean Manufacturing Principles" are applicable, as a value-added mechanism, for the timber industry. Our study revealed that the similarities between classical manufacturing and primary hardwood processing are sufficient to make Lean applications effective. Our study also revealed the need for Lean philosophy application across the full spectrum of hardwood primary processing.

Do you have problems getting the quality of logs that you want? (55% yes).

The answers to these two questions indicate that there is an overall supply chain problem and that the mill cannot realize its full potential until the supply chain problem is corrected.

Sawmills will benefit from the application of Lean principles, but the full benefit of Lean can only be realized if the entire supply chain is working together. In fact, we believe that the need for timber manufacturers to reevaluate the benefits of implementing Lean philosophy can no longer be questioned. Logical implementation of the basic Lean philosophy has been proven very effective, especially when applied with common sense. This is as true for the timber industry as it is for any other business.

OPERATIONS CONTROL SECTION		
Question	**Yes**	**No**
1. Is there a place designated for all items in the company?	55%	45%
2. Are there visual means to tell if the product is not being processed properly?	25%	75%
3. Is the flow within the company continuous with no queues (other than allowed by WIP considerations)?	55%	45%
4. Is standard work implemented throughout the company?	55%	45%
5. Standard work layouts and instructions are available or posted throughout the company?	15%	85%
6. Cycle times for products manufactured in the company have been standardized?	30%	70%
7. Does the company have a system to monitor the inventory?	35%	65%
8. Does the company manufacture products based on customer demand?	70%	30%
9. Are the employees in the mill cross-trained?	65%	35%
10. Standard work layouts and instructions for performing setups are available or posted throughout the company?	25%	75%
11. Is daily production prominently displayed for all to view?	40%	60%
12. Is variation reduction a company-wide goal?	35%	65%
13. Does the company do a root cause analysis for all abnormalities in its processes—production and business?	20%	80%
14. Does the company have a total productive maintenance program in place?	35%	65%
15. Performance measurements specific for the work area have been developed and displayed close to the work area?	30%	70%
16. Does the company have rewards and compensation tied into the performance measures?	40%	60%
17. Does the company undertake a regular review of the performance measures?	45%	55%

In our study of sawmills, we found a number of indicators which revealed the need for application of Lean principles in the milling industry. For example, in the Operations Control Section of our survey (see table below) the majority of sawmills indicated that they have implemented standardized work and that their employees are cross trained. From a Lean perspective, however, if standardized work were truly understood and implemented, a company would have also answered yes to questions 2, 5, 10, 12, 13, 15 and 16. Another example is the General Operations Section of our sawmill survey. Most of the questions in this section were designed to reveal an overall operational picture of sawmill activity in Missouri, but there were a few trigger questions such as:
Do you have problems getting logs? (75% yes); and

As kilns and sawmills begin to adopt Lean manufacturing principles they will eventually demand that loggers and landowners also implement Lean philosophy to increase their sustainability, competitiveness and improve their bottom line. It is very important to point out that success will only come to those kilns and sawmills committed to Lean reengineering along the entire supply chain and who use common sense in its application. Of course, the timber industry is not classical manufacturing and a strictly technical

application of Lean to primary processing of hardwood timber will only create conflicts in the recovery/inventory/cost equation of this business. We believe, however, that with proper application of Lean principles, sawmills have the potential of becoming the keystone for Lean applications in primary processing. For a mill or a kiln to be truly Lean, it will need the right supply of saw logs, in the right volume and at the right time. For this to work, Lean needs to be applied across the entire supply chain and not just in kilns or milling operations. But, it will not be easy to implement and it absolutely cannot be adopted through a "one time" training session conducted by a Lean technician offering a "cookbook" solution to all your milling problems.

LEAN IMPLEMENTATION PHILOSOPHY FOR MILLING OPERATIONS

a. ***The Woodlot***. Two of the most important Lean philosophies for a milling operation will be building relationships and implementing mechanisms to support material and product flow. The mill owner must constantly maintain a balance between having a sufficient feed supply and supplying finished goods. Even under the best of conditions, the mill has to contend with a raw material source that is not uniform in type or quality and a supply chain that can be seriously impacted by weather conditions. The market may be ready to purchase every board foot produced, but the capability to fill orders still remains a function of how well the right material flows at the right time.

Some mills may try to better control their raw material flow by purchasing standing timber and having their own logging crews. If a mill has sufficient credit or cash flow, purchasing standing timber is an excellent means of influencing raw material supply issues. Owning a logging crew is another matter. Most mills will not want or be in a position to assume the financial and legal burden of owning a timber harvesting capability. Instead, they will rely on contract loggers for harvesting purchased timber. This solution means having only a limited control over the quality of logs coming to the mill. This is especially true when the mill pays a fixed price per board foot regardless of quality. Under these conditions there is no incentive for the loggers to use care in recovering the maximum value from each tree or to better manage the flow of logs to the mill.

Purchasing timber is a step in the right direction, but to continue in the right direction, mills will have to invest time and resources in managing the harvesting operation.

In an attempt to offset their lack of control over the inflow of raw materials, most mills will try to maintain a large sawlog inventory. Under the prevalent timber business model, a large inventory of saw logs is the only means of supporting the flow of material through the actual milling process. To calculate a rough cost for this inventory, assume that a mill pays an average of $170 per mbf and maintains 5,000,000 bft in the woodlot. This means that the mill has a raw material storage investment of $850,000. According to standard industrial calculations, the inventory carrying cost will average $212,500 annually. Inventory carrying costs are real. They may vary 10 to 15 points from the average of 25% but they should not be ignored. The implementation of Lean principles will require a mill to determine if their lack of control over raw material flow is worth paying the inventory carrying costs of the woodlot.

b. ***Milling System***. By its very nature, a sawmill is designed to be a Lean operation. In almost all sawmills, production could take place as a continuous process of moving a single part throughout the entire process. A single log is debarked and passed to the head saw, where it is turned into lumber one piece at a time. Each single piece of lumber is passed to the edger where it is turned into one or more dimensioned pieces. Each dimensioned piece is passed through the trimmer and then sorted and stacked as finished goods. In many sawmills, there is no inventory existing between processes, except for

the single piece that is in transit. From the perspective of single piece flow and no inventory, the actual milling operation is already Lean.

However, a Lean operation is far more than single piece flow and no inventory. Lean is a philosophy that includes single piece flow, no inventory and no waste. From this perspective, most sawmills are not Lean operations. Lean requires that a mill capture the full value of each log flowing through the process. When the head saw down-grades what could have been recovered from a log or when the edger down-grades what could have come from a piece of lumber you are violating Lean philosophy. If the off-bearer stacks a grade board with blocking then you are violating Lean principles. Implementing Lean is more than single piece flow it is a philosophy that continually drives the mill to capture full value from each and every log flowing through the process.

c. ***Finished Goods***. Most sawmills know that they can sell what they make. The challenge is not finding someone to buy a sawmill's finished goods, but rather, finding someone willing to pay top price. One hundred and seventy three CEOs were asked, "Are your sales people calling on the right customers, at the right time, with the right offer?" Some 99.3% responded, "I don't know."

When surveyed, most sawmills said they were selling to the same customer (s) they had been selling to for years. Customer loyalty is not bad, but most mills did not have a proactive marketing program to seek out and engage the best customers. There seemed to know urgency to seek new and better customers and develop strong relationships with them.

In almost all industrial sectors, sales and marketing remain entrenched in the old way of doing business.

In many ways, this limits management scrutiny. Lean philosophy may be sweeping through the rest of the business, but it frequently will bypass marketing. Perhaps, because marketing and sales involves people interacting with people, not people operating with machines and managing processes. Also, many believe that salesmanship is a natural attribute and that it is not something you can train a person to do. The truth is that marketing and sales is still a business, with a business process, and that there is just as much opportunity for improvement here as anywhere else in the business.

Mills need a vibrant and active marketing program and a Lean marketing and sales program. A mill should ask itself:

- Are we aware of market signals?
- Do we always rapidly respond to market requirements?
- Do we service our customers better than any other mill in the are?
- Do we provide our customers with the quality of product they require?
- Do we always deliver on time?
- Do we know our market segmentation?
- Are we tracking lost orders?
- Do we know our market?
- Do we know the international market?
- Can we sell directly to the user instead of a middle man?"

These are just a few of the questions that ever mill should answer in a positive fashion and use in a continuous improvement program.

CONCEPT OF VALUE ADDED AND PROCESS WASTE

Although it may seem complicated, Lean transformation is really a simple process of knowing your customer's product expectations and then using Lean tools to eliminate waste in producing that product. Successfully executing Lean transformation requires recognizing waste in your production process and effectively using Lean tools to eliminate that waste. The elimination of waste must take place in every area of milling: the woodlot, debarking, sawing, edging, trimming and stacking. The goal of waste reduction in a mill is to use less human effort, fewer inventories, less time, less management, less control

and less space in a process aimed at exceeding customer expectation. In a process, there are basically eight common non-value added activities or wastes. Typically, the types of waste considered in a Lean manufacturing system include:

1. ***Overproduction -*** This means producing more than required by the customer or in the next step of the process or producing it before it is needed. Overproduction results from producing to speculative demand and requires storage of material. Causes for overproduction waste include:

- Just-in-case logic
- Misuse of automation
- Long process setup
- Unleveled scheduling
- Unbalanced work load
- Over engineered
- Redundant inspections

2. ***Waiting -*** Waiting for an action in the production process to take place is waste. Waste is waiting vital information, for a piece of equipment to be fixed, set up or to arrive at the needed location. Causes of waiting waste include:

- Unbalanced work load
- Unplanned maintenance
- Long process set-up times
- Misuses of automation
- Upstream quality problems
- Unleveled scheduling

3. ***Inventory or Work in Process (WIP)-*** Inventory or Work in Process occurs when material is piled up between operations due to large lot production or processes with long cycle times. Causes of excess inventory include:

- Protecting the company from inefficiencies and unexpected problems
- Product complexity
- Unleveled scheduling
- Poor market forecast
- Unbalanced workload
- Unreliable shipments by suppliers
- Misunderstood communications
- Reward systems

Normally excessive WIP can be reduced. But, in the timber industry, a WIP reduction program can be counterproductive. Reducing inventory can work, and probably will work, but it must be executed as part of an overall program.

4. ***Processing waste -*** This means is doing some thing in the process that is not required, or something that adds no value from the customer's perspective. Causes for processing waste include:

- Product changes without process changes
- Just-in-case logic
- True customer requirements undefined
- Over processing to accommodate downtime
- Lack of communications
- Redundant approvals
- Extra copies/excessive information

5. ***Transportation*** **-** Transporting a product does not add any value to it. Moving material from one process to the next should be minimized or eliminated. Causes of transportation waste includes:

- Poor plant layout
- Poor understanding of the process flow for production
- Large batch sizes, long lead times, and large storage areas

Use common sense. Logs are going to have to be moved, but keep transportation of logs at the mill to a minimum.

6. ***Motion*** - Unnecessary motion of the workers, machines or transport is waste and should be eliminated. Causes of motion waste include:

- Poor people/machine effectiveness
- Inconsistent work methods
- Unfavorable facility or cell layout
- Poor workplace organization and housekeeping
- Extra "busy" movements while waiting

7. ***Making defective products*** - Lean principles mean preventing defects instead of finding and repairing them. Causes of processing waste include:

- Weak process control
- Poor quality
- Unbalanced inventory level
- Deficient planned maintenance
- Inadequate education/training/work instructions
- Product design
- Customer needs not understood

8. ***Underutilizing people*** - Not taking advantage of people's abilities is a serious waste of a vital resource. Causes of people waste include:

- Old guard thinking, politics, the business culture
- Poor hiring practices
- Low or no investment in training
- Low pay, high turnover strategy

The Lean transformation process is the elimination or reduction of waste in a company's activities. Nearly every waste in the production and management process can fit into at least one of these categories. Understanding the concept of Lean means understanding that waste as the biggest enemy to business performance. Lean transformation is an approach that focuses on the elimination of waste in every aspect of a business.

PRODUCT FAMILIES

There is no single universal definition for a product family. Most engineers will define a product family as being a grouping of products from a common stock or process. For example, a bowl manufacturer may make the same type of bowls from walnut, maple, cherry and oak. Every bowl is made using the exact same process, but from a different stock. Thus there is a family of walnut bowls, of cherry bowls and so on. On the other hand, a manufacturer makes various items from oak. Processing some items may require the lath, others the saw, others the router and for a few may require every process in their production. In this case, product families may be identifiable as lath items or sawn items or routed items. Building product families requires common sense and a complete understanding of the manufacturing process.

Sawmill product families common in the hardwood industry can be defined in two different ways. The most common method is to describe sawmill products by the intended use of the final product. Typical usages are:

1. Blocking
2. Pallet
3. Tie
4. Grade
5. High Value Logs

Blocking and pallet products are generated in the greatest volume but have the lowest value. Ties have a decent value and the process for making a tie is the least complicated, thus making it one of the more profitable product families for a sawmill. Most Missouri sawmills sell the bulk of their grade products as feed for flooring mills. There is very little attempt to identify other grade families and capture the added value associated with higher quality products. The last common product family is high value logs. These are logs of uncommon quality or material type. It is not uncommon for a sawmill to sell these logs to a log buyer rather than saw them into dimensioned material.

One of the reasons we define product families is to analyze their impact on our company's bottom line. It is very helpful to know each product family's contribution to quantity of our over all production; how much it costs to product a given product family; or the product family's contribution to our profits. It is not uncommon to find that 20% of our products generate 80% of our profit or that the lowest 20% contributors to our profit consume 80% of our resources. For example, in the typical hardwood sawmill it is not uncommon to find the operation organized to support the production of blocking, which may be over 70% of the production but with the lowest profit margin. Under these conditions there is probably almost no production of high value grade material. An analysis of these conditions will provide a company with a clearer perspective on volume verses quality. There is a point where the two graphs intersect and it is here where the company should target its operational design. Too great a concentration on high-volume low-value product families could be costing a milling operation far more in profits than they think.

SPECIFIC LOGGING PROCESSES

The Woodlot

Introduction

The woodlot is an area commonly overlooked when seeking to identify waste, so it has become a very high waste producing area. No value is added to the product in the woodlot at all. This means that every task completed in the woodlot, interferes with the mill's competitiveness, adds to the mills unnecessary expenses that the client is not willing to pay for.

Of the eight waste in the Lean concept we commonly see four of them present in the woodlot phase of primary wood processing; Motion, Excess Inventory, Transportation, and Non-Value Added Processing. These wastes cause many problems that are not easily recognized because they are embedded deeply in tradition. The woodlot today is quite often operated the way it has been for centuries. With the current state of the industry, there is now more than ever a need to increase the competitiveness of your mill. To do this, you can not overlook the woodlots potential benefit on the overall operation. For this section we will cover each of the identified waste in greater detail and show how the use of tools from the Lean Toolbox can be implemented to solve these problems.

Woodlot Observations

1. Excess Inventory

Excess inventory is one of the top wastes found on the woodlot. The majority of other sources of waste are due to the excess inventory and the lack of inventory control. There are factors that have brought mill operators to believe that this is a necessary condition; Weather and variation in supply are two examples. This frame of mind has led to storing this inventory during times of the year that it is unnecessary. Many times a mill will say that it has the needed amount in inventory. However, with no inventory controls, it is no more than a guessing game. It is important that a mill know what it has purchased to ensure that it never purchases more than it need.

2. Motion

Motion waste is a hard waste to define and identify, however it does exist on the woodlot. A good example of motion waste is using a skidder to sort through the scaled logs in order to get a full load to take to the stacking piles. This is a waste that could be eliminated with the use of a forwarder.

3. Transportation

Transportation in the woodlot is greatly related to the excessive amount of inventory and storage methods. A Skid Loader operator is forced to travel long distances with a few logs at a time to stack them in their proper locations. The ideal way to solve this problem would be to eliminate inventory and offload trucks directly onto the debarker, however, due to the lack of control over the logs coming in this is not an option. We must remember that every time we do anything that the customer is not willing to pay for we are simply cutting our profits. Every movement that is made by one of our employees is being paid for, and if it is not a movement that adds what the customer deems to be value to the product then it is taken out of our profits.

4. Non-Value Added Processes

When looking at non-value added processes, we must remember that some non-value added processes that are necessary; however, we must reduce them as much as possible. As mentioned earlier no value is added to the product during its time in the woodlot. The value adding process begins at the debarker. Therefore, it is important to eliminate every possible part of this process to decrease the cost for which the customer will not pay. Examples of this waste include painting sizes on the logs instead of having set places for each size that is already marked. This is just one simple idea of what we are trying to solve here.

Applying the Lean Tool

When we began to look into solving this problem we must look at the alternatives; then sort them accordingly to their practicality. There may be many solutions to the problem that counteract themselves due to the cost it takes to implement them. For instance, a solution that will save you $100 but cost $1,000 to implement is really not a solution. That is the reason Lean experts recommend that you prioritize improvements by their cost, ease of implementation, and impact

Here are some of the Lean tools that can be used to assist in improving the current situation.

1. Facility Layout. This requires us to set up our processes in a way that eliminates waste. Many times facilities are set up in a way that requires excessive movement to get the product through each process. By changing the facility layout it is possible to set each process in chronological order.

2. Standardized Work. Standardized work consists of establishing and posting one way to do a certain task. This will eliminate variations in processes which will in turn reduce waste and increase quality.

3. Visual Controls. Visual Controls uses signs, colors or shapes to communicate messages to any in the facility. An example of this is using signs to communicate log sizes. Visual controls allow personnel to know exactly what is going on in a workplace with a brief glance.

4. Line Balancing. This consists of looking at the time each operation takes and evening out the load to prevent bottlenecks. The easiest way to asses your current situation is by completing the value stream mapping process. This will identify how long each operation takes and allow you to see the best solution.

5. Point of Use Storage. Point of Use Storage is having supplies placed where they will be used. An example of this is having the logs close to the debarker process. This will eliminate much of the transportation waste in the woodlot.

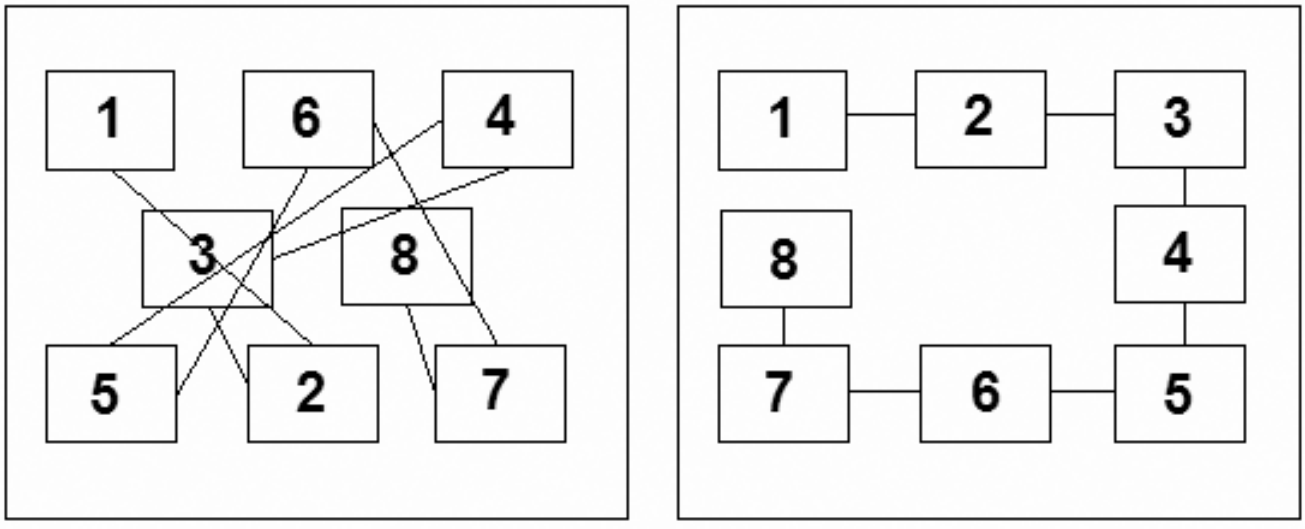

Figure 2

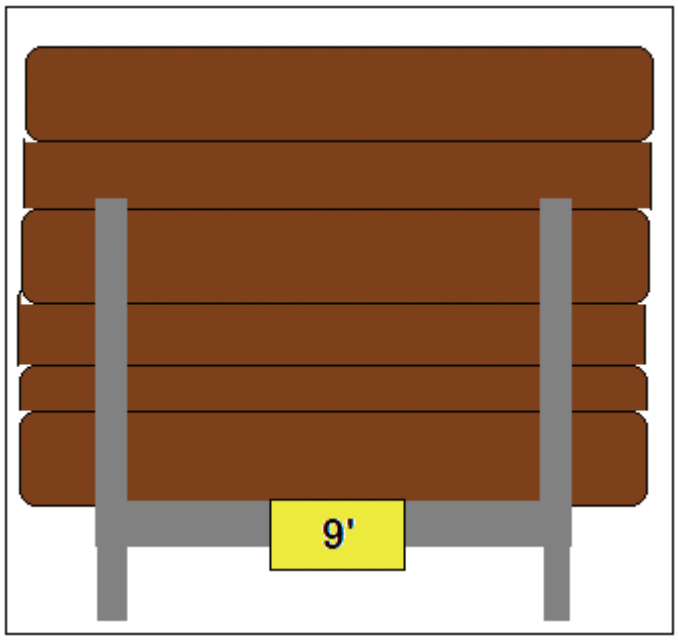

Figure 3

6. Value Stream Mapping. A value stream map is a graphical representation of every operation involved in your company to allow you to see the overall operation at a glance assisting in identifying problems in your operational flow.

7. Continuous Improvement. The Lean concept is a never ending improvement process. It requires that you continuously search for ways to improve your company. By establishing a continuous improvement team you can constantly assess your operation and develop ideas for improving it.

Conclusion

Now that we have identified several types of waste in the woodlot and have taken a look at some of the tools for improvement lets put them all together and look at some possible solutions to the overall problem.

In the Woodlots current state assorted loads of logs come into the woodlot. They are unloaded, sorted, graded, stacked, then pulled and placed on the debarker. Remember, none of these processes add value to the product. So, to begin we must look at the processes and establish how they can be eliminated, compounded or simplified to reduce their cost.

Below is a diagram of a possible solution. This diagram shows an operation where a presorted truck will unload onto the decks for the logs to be graded. After being graded they will be released to roll down into the supermarket. From the supermarket the conveyor will carry the log to the debarker live deck, and then the log will be released onto the second supermarket to await the head saw. From there the conveyor will place the log on the live deck for the head saw.

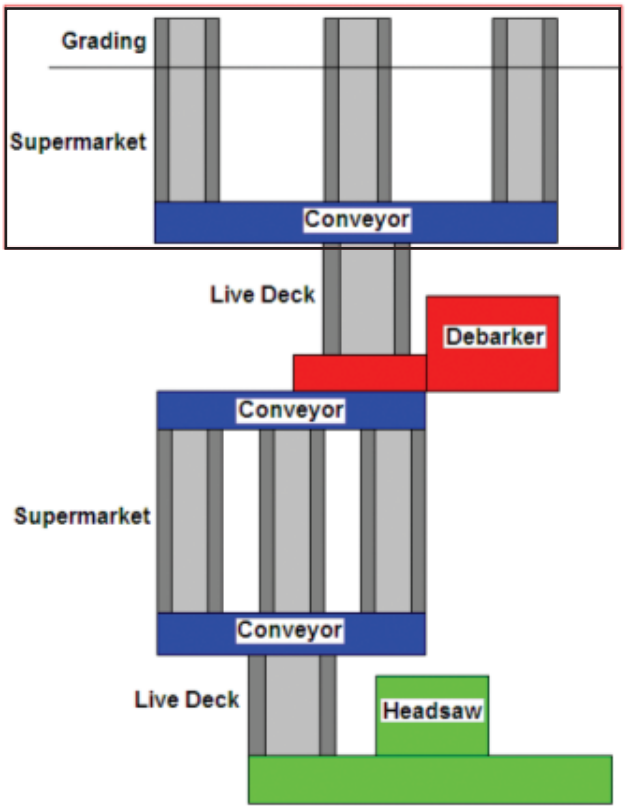

Figure 5

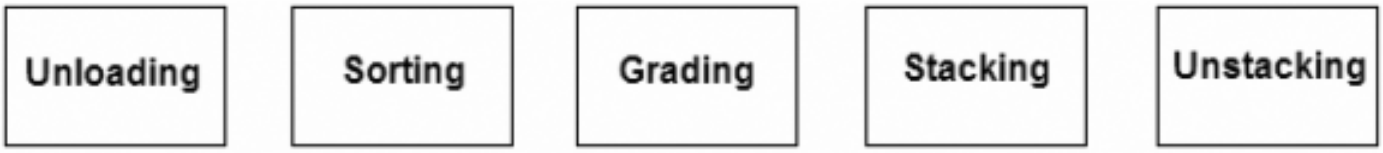

Figure 4

To put in one supermarket conveyor combo it would cost approximately the same as purchasing a skidder with far less upkeep. When you first look at the Lean concept, you must begin with simple and low cost ideas. These would be inventory controls, point of use storage, setting up standard procedures for each job and so forth. Lean is not about spending more money. It's about spending money most effectively. Many people think that when you implement Lean that jobs will be lost. The point is to not eliminate jobs, but to use your employees most efficiently.

If a company is interested in implementing Lean into their mill the woodlot is an important place on which to concentrate. Remember not to let tradition dictate how successful you will be in the future.

DEBARKER

Introduction

The debarker process is not an essential process, but it does allow improved efficiency and adds value to the unavoidable waste byproducts. If a debarker is not installed at a sawmill, slabbing the logs is required. This takes more than 20% of the log and turns it into an invaluable waste product. By debarking a log you decrease the wear on the head saw, add visibility to foreign objects, get a high value mulch to sell and allow the slabs coming off the head saw to be chipped and turned into a high value product. This one process will increase the profits of the mill while decreasing the maintenance cost to the head saw. The current wholesale market price is approximately $16-$22 per ton for bark free chips delivered and $15-$16 per ton delivered for bark mulch. Many mills are selling bulk retail directly from the mill yard for $20-$30 per cubic yard for their mulch and selling their chips wholesale.

The majority of the waste at this area of the sawmill is not caused by employees, but by the equipment used. Some of it is caused by the company's policies toward equipment and effects the way the equipment is treated and maintained.

Of the eight wastes in the Lean concept we often see five of them in the debarker process. These are overproduction, excess inventory, transportation, non-value added process, underutilized people and waiting. Some of these wastes are not seen in every saw or they may be rare. But, they have impact on the mill and should be addressed.

Debarker Observations

1. *Overproduction*

Overproduction is often caused in the debarker process due to the low machine reliability. This is an effect of maintenance issues. Many times a debarker will be operated until an inventory is built up for a safety in the case of malfunctions. Often the problems causing the malfunctions are due to simple problems that could be solved by performing regular maintenance and by having needed tools and replacement parts on hand. Other than the elimination of waste another reason to avoid overproduction is the dirt and mud that sticks to the debarked logs causing extreme wear on the saw blade.

2. *Excess Inventory*

This waste is a result overproduction. Excess inventory seriously implicates the mills efficiency.

3. *Transportation*

Transportation waste is generated by taking the log from the debarker to the inventory stack, then from the inventory stack to the head saw. This process cost the mill money that can not be added to the price of the finished product. By eliminated the inventory or by using innovative methods this waste could be eliminated increasing the mills profit.

4. *Non-Value Added Processes*

This waste is seen when there is a lack of training and the debarking process time is increased and

when teeth are not maintained resulting in extra time and work for the machine. Small items such as these can cause losses never imagined by the mill. These problems are good examples of simple solutions that offer tremendous improvements to the mills efficiency.

5. ***Underutilized People***

Underutilized People is not something seen at every mill, however, we will investigate this problem to demonstrate possible solutions. When looking for a solution to this problem you will need to look at the plant as a whole using the value stream map, and begin to balance the work load.

6. ***Waiting***

Waiting Waste is accumulated during machine down time when a replacement part is not readily available, and when there is not an adequate supply of logs to the debarker. These wastes are easily avoidable by applying the Lean tools.

Applying the Lean Tools

The debarker process is a process that you can implement Lean into with low cost changes. This allows a company to get employees involved and trained in the Lean philosophy without a large capital outlay. Below are some of the Lean tools that could be used to solve the problems in debarking:

1. ***Total Productive Maintenance***. This involves scheduling maintenance on your machinery to prevent downtime. This could be implemented during the slow seasons for major maintenance or once a month for minor upkeep. By scheduling task such as changing belts you can reduce the waiting time for a replacement part as well as plant downtime when the head saw runs out of logs.

2. ***Point of Use Storage***. Point of Use Storage requires placing items where they will be used to eliminate transportation waste. By purchasing items like belts and placing them at the debarker you will greatly reduce machine downtime.

3. ***Facility Layout.*** By implementing Lean concepts into a facility layout you organize the processes in a way that eliminates waste. Many times facilities are set up in a way that requires excessive movement to get the product through each process. By changing the facility layout it is possible to set each process in chronological order. This would include setting up a supermarket to reduce transportation waste.

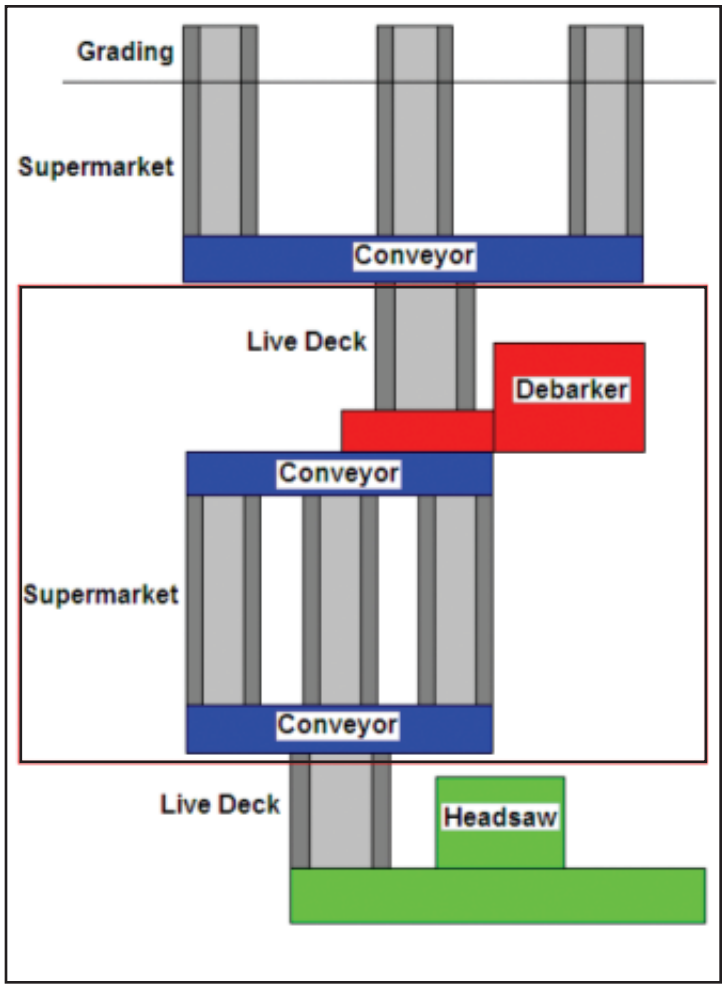

Figure 6

4. ***Continuous Improvement***. The Lean concept is a never ending improvement process. It requires that you continuously search for ways to improve your company. By establishing a continuous improvement team you can constantly assess your operation and develop ideas for improving it.

Conclusion

After identifying some of the waste in the debarker process and outlining a few tools to correct them its time to combine them and look at possible solutions. By implementing total productive maintenance and scheduling our downtime combined with point of

use storage to keep frequently used replacement parts close to the debarker, the efficiency of the debarker is increased greatly. With the teeth kept properly and the belts on hand the cycle time is decreased and the machine downtime is reduced so a greater number of logs to be processed in less time. Now that we have improved the efficiency of the debarker process it is time to tackle the transportation waste between the debarker and the head saw.

This can be improved by many different implementations depending on the amount of capital investment available. The easiest way to solve this problem is a type of Kanban system for holding the logs until needed by the head saw. The manner in which this system is created will determine the cost. For instance you could have a computerized system as shown above that is automatically loaded into the selected shoot and is loaded onto the head saw deck through a signal from the head sawyer. Although, this sounds complicated and expensive it could be put into place for approximately the same price as a skidder and would cost far less to maintain. To resolve the over processing training and practice will be require for the employee operating the debarker.

HEAD SAW

Introduction

The head saw is an area that is commonly watched very closely and there is little noticeable waste. This process is completely dependant of the experience of the sawyer and the technology available to him. The Missouri sawmill industry is currently performing a great job as far as the Lean wastes at the head saw are concerned. The main lost in Missouri's head saw processes is sawdust and lack of continuous head sawyer training. In this section we will discuss how training and equipment can affect the mill's efficiency.

Training

In today's sawmills, it is common for a head sawyer to gain experience operating the saw and quickly adjusting the log on the carriage. However, once he reaches a certain point of experience, training stops. Thus, mill reaches a certain efficiency level, further improvement stops. The commitment to change this cycle has to come from the upper management. Once the company leaders set establish a program that requires head sawyers to constantly attend training on new methods and systems to increase their efficiency the mill hands will eventually become involved.

To continue their training a head sawyer can read literature and attend sessions established by state agencies, private hardwood programs, universities and others.

Equipment

New technologies and equipment are constantly being developed.. Sometime keeping up with the latest gadget can be impossible, however, there are some proven technologies that have greatly changed the face of the sawmill industry. In this section we will briefly investigate a few of these technologies and evaluate their worth in a mill.

Due to the increased rate of cut and the reduction in waste generation the band saw has greatly changed the sawmill industry. The smaller sawmills have shown a reluctance in converting to a band saw due to the capital investment. Many times a mill fails to look at the whole picture. When investigating the possibility of converting you must look beyond just the cost to the payback.

To evaluate the need of a band saw you must compare your current equipment on a few major characteristics.

Cycle time. The cycle time is the time it takes to make one line through the log.

Cutting width. The cutting width is a major factor. The larger the cutting width the larger percentage of the log becomes waste. This greatly affects the mill's profit over a year's time.

Machine reliability. The machine reliability refers to percentage the machine spends down. Every second the saw is not running the mill is losing money. Even the number of times the blade needs replaced or sharpened should be figured in here.

With these factors in mind the mill operator needs to compare the current machinery with the band saw option.

Another technology needed to be considered by the mill is a light curtain. This can be utilized in a way that the computer will send a signal to the head sawyer to let him know the optimal way to turn the log on the carriage. This is a piece of technology that would possibly need a higher quantity of logs to make it viable.

Conclusion

The head saw process is currently fairly efficient, however, we always seek to identify waste and eliminate it. By looking into new methods and technologies that are always surfacing we can enter into a level of efficiency that was not possible twenty years ago.

EDGER

Introduction

The edger produces a rough sawn width for lumber produced by the head saw. Most mills employ a double-saw edger where one blade is fixed and the other blade movable. The operator lines a board up with the saw and then positions the movable blade to remove enough of the wane to produce the highest grade board possible. More advanced edgers have a laser, which is lined up with the movable blade, projected on the board to provide the operator with a visual indication of the cut line. Once the operator is satisfied that the board is properly lined up they push it into the saw and it mechanically drawn through the saw. The board is then off-loaded and the cut off edgings are sent to a chipper.

Edger Observations

From a Lean perspective there are very few of the eight classical wastes associated with the edging process. The edger is single peace flow with almost no WIP before or after this process. Yet, in spite of its intrinsic Lean nature the edger is probably the single greatest value loosing sawmill process. It is extremely easy to lose more than half of a board's value because it was cut in the wrong place and at the wrong width. Observation indicates that the amount of value lost appears to be directly proportional to the overall production volume rate. In other words, the harder the edger is pushed to produce high volume the greater the board value being lost at the edger.

Applying the Lean Tools

In all probability, the most applicable Lean tool for the edger will be development of detailed work standards. These standards need to be followed by extensive training and the use of visual aids in determining quality. There is an abundance of literature dealing with proper edging standards and there are also excellent computer training programs available. Edger operators should also be provided with illustrations and posted data to aid in decision making. With the availability of computer simulations for sawing and edging it would probably be advisable to develop a refresher training program that operators had to go through on an annual basis.

Conclusion

The edger, much as the head saw, it the one place where a sawmill will make or lose money. In fact, evaluations have shown that it is not unusual for the edging process in a hardwood mill to lose 20 to 25 percent of the value of the material flowing through the process. There is not a single sawmill visited in this study that could not benefit through a more detailed edger training program. Of course sawmill must also address the need to balance production volume with quality. It is our opinion that many sawmills are loosing more money, because of poor quality, than they are making by seeking to increase volume.

STACKING

Introduction

Stacking is an area often overlooked when improvement ideas are being considered, usually because it is seen as a low skill level, low paying job;. But, there is significant waste commonly generated at this area. Many times the employees involved in stacking are not properly trained nor identified as important parts in the sawmill industry. The stackers are responsible for the mill's quality image to their customers. If grades are mixed up or lumber is poorly stacked that is the way the mill's product will be judged by the customer. When we fail to take notice of this process we could greatly damage our customer relations this being particularly important during time when lumber is difficult to sell.

Of the eight wastes in the Lean concept we commonly see three of them present in the stacking process; underutilized people, waiting, and defects.

Stacking Observations

1. Underutilized People

Many times having underutilized people results from the opinion that says a mill needs to employ extra people in the case that they need someone later. For this reason mills have stackers that need only work half the time to stay caught up. This results in a large loss of money for the mill.

2. Waiting Waste

Waiting waste in the stacking process is a result of underutilized people. The stacking process will have more employees than required which results in some of them standing around without work.

3. Defects

Defects in the stacking process include both improper stacking techniques and products being mixed. This is caused many times by the lack of training for the stackers and the lack of emphasis placed on zero defects. This is not relayed to the employees because the importance is not seen by the upper management.

Applying the Lean Tools

The stacking process is another process that you can implement Lean into with low cost changes. This allows a company to get employees involved and trained in the Lean philosophy without a large capital outlay. Below are some of the Lean tools that could be used to solve the problems mentioned above.

1. Teams. This tool involves organizing the employees of this process together to allow an ownership to develop.

2. Line Balancing. Line Balancing consists of looking at the value stream map and determining the best way to utilize your resources.

Conclusion

The stacking process will easily be improved by balancing the workload, followed by establishing teams. This will give stackers an opportunity to give their input on the process. Training will be imperative to the success of this project. Once the employees are taught the proper way to fulfill their job they will be able to provide ideas on the further improvement of this process.

CONCLUSION

We are certain that Lean principle will have a positive impact on the timber industry especially in the processes of milling. In considering the role of Lean in the future of the timber industry, it is important to realize that there are two basic approaches in the implementation of Lean principles. One approach is to apply Lean patches to portions of the existing system. A second approach is to undertake a holistic Lean implementation program that is applied to the entire primary process. There is no right or wrong associated with the two basic methods. The avenue you choose to take is a function of what you want to get from the program. But, application of Lean to only one activity in primary processing will only produce limited results. For the full impact of Lean to be realized in primary processing of hardwoods it must be applied across all four timber activities: landowner, logger, mill, and kiln/planner.

The Lean patches approach views Lean as a box of tools, which are designed to fix specific activities. In this commodity method of Lean implementation, a practitioner trains a company in the general philosophy of Lean and then aids the company in applying Lean tools to fix various activities, which are almost always directly associated with one activity or even worse only a few parts of a single activity. This approach will most often realize performance improvements by minimizing wastes in a single process; such as edging. The missed opportunity in this commodity approach; however, is its tendency to address a few small process silos, while ignoring the overall process. Unfortunately, most of the hardwood primary process consists of functional silos, which are nothing but vertical structures built on narrow pieces of the overall process. People involved in these stovepipes (kiln, mill, logging, landowner) look inward on their own activities and upward toward their own bosses, but seldom look outward toward the complete process or to the end user. Applying this commodity approach to just the sawmill will produce some improvements but this approach will leave the primary processing structure unchanged; and the full capability of Lean philosophy will never be realized.

The Holistic Lean approach employs all the commodity tools, but more importantly it directly addresses the fragmented processes, or specialized activities, and replaces them with an efficient and flexible supply chain capable of rapidly reacting to changes in the market. It is impossible to explain Holistic Lean implementation, sometimes called World-Class Reengineering, in a few paragraphs. There are, however, a number of common transformation attributes that a company should experience. A few typical changes found in classical manufacturing are as follows:

1. The company becomes process focused rather than activity oriented.
2. Workers are no longer associated with tasks; instead teams are associated with processes.
3. Managers no longer supervise and control task-encumbered workers because workers in a team now make process decisions as a team function.
4. The need for managers is replaced with the need for leaders.
5. The need to supervise is replaced by the need to educate, coach, encourage, empower and negotiate.
6. Real time process management, by the opera tors, eliminates the need for extensive checks and controls.
7. Workers are not hired to do specific single tasks; they are now hired to do multiple complex tasks associated with a team's missions.
8. Pay and reward is no longer based on your title, how many people you supervise, or what you do, it is now based on the results you produce.

9. Advancement is no longer based on who you are, the number of people you supervise, how long you have been with the company, or your title; it is now based on your ability to lead, motivate, empower, create, teach, innovate, and produce.
10. Department style management eventually fades away and is replaced by processes, which are led by leadership teams
11. Customers have multiple points of entry into the company and receive information or assistance almost instantly.
12. The hierarchical governance structure is done away with and replaced by process and leader ship teams.
13. Senior managers are no longer score keepers and they now function as visionary leaders and sources of empowerment.

It has been stated that, "The challenges of re-engineering will strike fear in the timid, those who are not destined for world-class standing, but these same challenges will arouse fervent anticipation in the bold, those who will lead their company into the 21st century." The implications of Holistic Lean should be viewed as a radical redesign of your business to achieve unprecedented advancements in measures of performance such as: cost, quality, innovation, employee performance, service and delivery.

Missouri Enterprise applauds your desire to improve your company's performance. We are certain that the efforts you make in better understanding your own company, the business trends of the 21st century, and modern business practices will be well worth the time spent. We would also like to recommend that your consideration for starting a Lean program be predicated on your understanding of the subject and on your having a very strong commitment to the program. Starting Lean implementation is like starting a diet … the only right time is when you are fully committed to the process ahead. You certainly seem to have the will to improve, and thus the degree of improvement will be directly proportional to your devotion to change.